Asian Journal of Chemistry Vol. 17, No. 3 (2005), 1823–1826

Investigations on the Changes in Mineral Composition of Turkish Hazelnuts (*Corylus maxima* Miller)

F. GÜLAY KIRBAŞLAR, AYDIN TAVMAN*, ARTAÇ TÜRKER† and SELÇUK TÜRDÜ†
Department of Chemistry, Faculty of Engineering, Istanbul University
34320, Avcilar, Istanbul, Turkey
E-mail: atavman@istanbul.edu.tr
Tel: (90)(212)4737070; Fax: (90)(212)5911997

Mineral composition in Turkish hazelnuts (Foşa) was investigated for consecutive six years between 1994–1999. Sodium, potassium, magnesium, calcium, phosphorus, iodine, iron, manganese, zinc, molybdenum, selenium contents of hazelnut samples were determined using atomic absorption spectroscopy and colorimetric methods. The mean contents of iron, calcium, magnesium, potassium, sodium, zinc, manganese, phosphorus, iodine, molybdenum and selenium are 4.51 ± 0.46, 127.19 ± 3.31, 175.71 ± 2.52, 568.95 ± 4.80, 2.09 ± 0.32, 2.92 ± 0.07, 9.39 ± 0.15, 270.61 ± 2.62, 4.20 ± 0.09, 0.84 ± 0.09 and 2.51 ± 0.11 mg/100 g, respectively. The differences in the analyzed mineral constituents were tested by the ANOVA statistical test.

Key Words: Mineral composition, Turkish hazelnuts, *Corylus maxima* Miller.

INTRODUCTION

Some elements are essential for maintaining the life events in human body. They may be divided into two main categories: *main elements* (calcium, phosphorus, potassium, sodium, magnesium) and trace elements (iron, zinc, manganese, iodine, molybdenum, selenium, etc.). Essential elements, including the main elements and a number of trace elements, fulfil various functions: such as electrolytes (sodium, potassium, magnesium, calcium), in enzymes, vitamin, hormone constituents (sodium, potassium, manganese, zinc, iodine, molybdenum, selenium) and building materials, *e.g.*, in bones and teeth (calcium, phosphorus, magnesium). It is known that iron has a very important role in the formation of haemoglobin[1–3].

In recent years, it has been found that nuts, such as pistachio, peanut, almond, walnut and hazelnut, have a considerable role in healthy nutrition and they contribute to the daily nutritional needs. Especially, nuts give the highest nutrient

†TUBITAK, Marmara Research Center, Material and Chemistry Technologies Research Institute, Gebze, Kocaeli, Turkey.

supply to the human body by oils and proteins. On the other hand, it is known that these nuts are an important source of minerals required for health[4–10].

Turkey is the largest producer of hazelnuts in the world, contributing about 70% to the total hazelnut world production. Black Sea Region is the main area of hazelnut cultivation, which represents about 97% of the total production of Turkey[11]. The mineral composition and other contents of hazelnut are affected by variety, geographical origin, harvest year, climate and the methods of cultivation[5–7].

The purpose of this study is to determine the dissociation mineral composition of Turkish hazelnut (Foşa) (*Corylus maxima* Miller) by climate (rain, humidity, temperature etc.) for six consecutive harvesting years and to investigate the significant difference ($P < 0.05$).

EXPERIMENTAL

Sampling: Turkish hazelnuts (Foşa) (*Corylus maxima* Miller) of six consecutive harvesting years (1994–1999), which were produced in the Trabzon area, were taken for investigation. The hazelnuts were collected every year from the trees at the beginning of September. Naturally dried samples were stored at 4°C and 60–65 % relative humidity along with the shell. Analyses were performed on the powder prepared from the unshelled hazelnut, ground in a blender and sieved with a 0.5 mm hole sieve. All analyses were carried out in triplicate.

Statistical Analysis: Experimental results were obtained by a one-way analysis of variance calculation (ANOVA).

Chemical Analysis: Mineral composition was determined with an atomic absorption spectrophotometer (Hitachi 180-50) and a Jenway flame photometer. Molybdenum, phosphorus and iodine analyses were performed by colorimetric method.

RESULTS AND DISCUSSIONS

Mineral composition values of Turkish hazelnut (Foşa) (*Corylus maxima* Miller) for six consecutive harvesting years (1994–1999) and statistical data are given in Tables 1 and 2, respectively.

Earlier, several resevrchers[9, 10, 12–15] conducted the studies on mineral composition of Turkish hazelnuts and concluded that there are considerable differences between the Turkish hazelnut varieties. It was determined that the quality of hazelnut is affected by some factors such as varieties, climate, growing conditions, chemical characterization of the soil, watering and fertilization[4–8].

The average data of mineral composition in this study are supported by the results in literature[9, 10, 12–15]. The average data in this study and the literature data range (in parentheses) are the follows : iron 4.513 (2.23–5.91), calcium 127.186 (85.88–156.10), magnesium 175.713 (137.70–208.0), manganese 9.388 (1.60–11.22), potassium 568.945 (489.0–730.2), sodium 2.093 (0.28–1.93), zinc 2.918 (1.85–3.02), phosphorus 270.613 (246.0 mg/100 mg)[10] (Table-1).

TABLE-1
MINERAL COMPOSITION OF TURKISH (FOŞA) HAZELNUT SAMPLES (mg/100g)[a]

	1994		1995		1996		1997		1998		1999	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Iron	3.86	±0.46	4.34	±0.42	4.93	±0.35	5.42	±0.43	3.32	±0.51	5.21	±0.58
Calcium	141.03	±3.58	129.71	±3.46	123.55	±2.92	110.20	±3.43	96.17	±3.64	162.46	±2.83
Magnesium	201.33	±2.54	219.35	±2.60	151.87	±2.22	154.96	±2.59	152.99	±2.62	173.76	±2.54
Manganese	9.13	±0.16	8.75	±0.13	9.69	±0.14	9.21	±0.16	9.35	±0.13	9.90	±0.18
Potassium	486.33	±4.79	645.80	±4.63	505.69	±4.69	561.31	±5.10	549.89	±4.92	664.65	±4.76
Sodium	2.06	±0.36	2.39	±0.34	1.57	±0.27	2.94	±0.35	1.68	±0.37	1.92	±0.21
Zinc	2.11	±0.05	2.92	±0.04	3.20	±0.12	3.10	±0.08	2.97	±0.08	3.21	±0.06
Iodine	4.13	±0.12	3.94	±0.08	4.10	±0.11	4.30	±0.06	4.37	±0.08	4.34	±0.06
Molybdenum	0.82	±0.12	0.79	±0.09	0.82	±0.11	0.86	±0.06	0.87	±0.10	0.87	±0.09
Selenium	2.43	±0.08	2.37	±0.09	2.46	±0.14	2.58	±0.13	2.62	±0.10	2.61	±0.10
Phosphorus	331.12	±2.40	244.36	±2.35	242.67	±2.44	240.71	±.57	281.50	±2.82	283.32	±3.11

[a] Each value is a mean ($\bar{X}$), standard deviation (SD) of three determinations.

There is no information about iodine, molybdenum and selenium in hazelnut in the literature and we suppose that these elements are hereby detected for the first time in this nut.

The average iodine content of Turkish hazelnut (Foşa) is found to be 4,196 mg/100 mg, while the average molybdenum content of Turkish hazelnut (Foşa) is found to be 0.838 mg/100 mg in this study. The average iodine, molybdenum and selemium contents, were found to be 4.196, 0.838 and 2.37–2.62 mg/100 g, respectively, in the present study. The selenium content is found to be considerable high level in hazelnut.

TABLE-2
STATISTICAL DATA: MEAN ($\bar{X}$)[a], STANDARD ERROR OF MEAN (SE) AND SIGNIFICANCE LEVEL FOR MINERAL COMPOSITION OF TURKISH HAZELNUTS (FOŞA)

	$\bar{X}$	SE	p
Iron	4.513	0.044	0.033
Calcium	127.186	1.349	0.015
Magnesium	175.713	1.259	0.032
Manganese	9.388	0.022	NS[b]
Potassium	568.945	2.190	0.024
Sodium	2.093	0.099	0.026
Zinc	2.918	0.052	NS
Iodine	4.196	0.007	NS
Molybdenum	0.838	0.008	NS
Selenium	2.512	0.011	NS
Phosphorus	270.613	1.617	0.023

[a]Each value is a mean of three determinations. Significantly different at $p < 0.05$.
[b]NS, not significant.

In literature[14], significant differences were observed between magnesium, potassium, sodium and zinc. Açkurt *et al.*[14] reported that there were no significant differences in iron, calcium and manganese. However, Özdemir *et al.*[15] observed significant differences in iron, manganese, potassium, zinc, sodium, magnesium and calcium in Turkish hazelnuts. In present study, significant differences are observed in iron, calcium, magnesium, potassium, sodium and phosphorus minerals according to the six years ($P < 0.05$). However, there are no significant differences in manganese, iodine, molybdenum and selenium minerals of Turkish hazelnuts. Therefore, it can be said that the climatic factors (rain, temperature, humidity, etc.), soil, watering and growing conditions cause significant differences in iron, calcium, magnesium, potassium, sodium and phosphorus level of hazelnut. On the other hand, the data in this study show that Turkish hazelnut (Foşa) is rich in manganese, sodium, zinc, phosphorus, iodine and selenium content.

REFERENCES

1. H.D. Belitz and W. Grosch, Food Chemistry (Translation from the second German edition by D. Hadziyev), Springer-Verlag, Berlin-Heidelberg (1987).
2. M.H. Weinberger, *ISI Atlas of Science Pharmacology*, **2**, 175 (1988).
3. H.W. Gruchow, K.A. Sobucinski and J.J. Barbuirak, *Am. J. Clin. Nutr.*, **4**, 1463 (1988).
4. G.E. Fraser, J. Sabate, W.L. Beeson and T.M. Strahan, *Arch. Intern. Med.*, **152**, 1416 (1992).
5. A.S. Pershern, W.M. Breene and E.C. Lulai, *J. Food Process Pres.*, **19**, 9 (1995).
6. J. Parcerisa, J. Boatella, R. Codony, A. Farran, J. Garcia, A. Lopez, M. Rafecas and A. Romero, *Food Chem.*, **48**, 411 (1993).
7. J. Parcerisa, M. Rafecas, A.I. Castellone, R. Codony, A. Farran, J. Garcia, A. Lopez, A. Romero and J. Boatella, *Food Chem.*, **53**, 71 (1995).
8 J.S. Bonvehi and F.V. Coll, *Food Chem.*, **48**, 237 (1993).
9. M. Ayfer, A. Uzun and F. Baş, Turkish Hazelnuts Varieties, Black Sea Hazelnut Exporters Union, Ankara, Turkey (1986).
10. F. Baş, S. Ömeroğlu, S. Türdü and S. Aktaş, *Gida*, **11**, 195 (1986).
11. FAO Yearbook of Production, FAO Statistics Series, Rome, p. 46 (1992).
12. E. Alphan, M. Pala, F. Açkurt and T. Yilmaz, *Acta Horticult.*, **445**, 305 (1996).
13. M. Pala, F. Açkurt, M. Löker, M. Yildiz and S. Ömeroğlu, *Turkish J. Agricult. Forestry*, **20**, 43 (1996).
14. F. Açkurt, M. Özdemir, G. Biringen and M. Löker, *Food Chem.*, **65**, 309 (1999).
15. M. Özdemir, F. Açkurt, M. Kaplan, M. Yildiz, M. Löker, T. Gürcan, G. Biringen, A. Okay and G. F. Seyhan, *Food Chem.*, **73**, 411 (2001).

(*Received*: 11 October 2004; *Accepted:* 16 April 2005) AJC-4174